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Abstract

Pedagogical content knowledge (PCK) is the intersection of a teacher's knowledge of content, pedagogy, and of the context of the learning situation, including her students. Many different methods have been used by researchers to study PCK. We propose that PCK cannot be measured through one approach. Rather, it is more accurately measured by triangulating data gathered through observation of instructional events, teacher interviews, and assessments of content knowledge. This is illustrated through a case study of Maria, a paraeducator leading small group reading intervention lessons in a kindergarten classroom over a period of 10 weeks.

Keywords

Pedagogical Content Knowledge, Elementary, Paraeducator, Literacy Intervention, Case Study

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Measuring Pedagogical Content Knowledge Using Multiple Points of Data

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Pedagogical content knowledge (PCK) is the intersection of a teacher's knowledge of content, pedagogy, and of the context of the learning situation, including her students. Many different methods have been used by researchers to study PCK. We propose that PCK cannot be measured through one approach. Rather, it is more accurately measured by triangulating data gathered through observation of instructional events, teacher interviews, and assessments of content knowledge. This is illustrated through a case study of Maria, a paraeducator leading small group reading intervention lessons in a kindergarten classroom over a period of 10 weeks. Keywords: Pedagogical Content Knowledge, Elementary, Paraeducator, Literacy Intervention, Case Study

Pedagogical Content Knowledge

Lee Shulman's (1987) work on Pedagogical Content Knowledge (PCK) posits that accomplished teachers draw upon unique knowledge and skill bases in order to be successful in their teaching. His ideas on this topic have long been a theoretical and practical foundation for the evaluation of teaching practice.

Shulman described PCK as that "special amalgam of content and pedagogy that is uniquely the province of teachers, their own special form of professional understanding" (1987, p. 8). He emphasized the importance of PCK as the single characteristic that separates someone with content knowledge from a teacher who can represent ideas, "so that the unknowing can come to know, those without understanding can comprehend and discern, and the unskilled can become adept" (1987, p. 7).

Pedagogical Content Knowledge is the difference in how a laboratory chemist and a chemistry teacher would plan and teach a chemistry lesson. The chemist may be able to tell students about the topic, but the skilled chemistry teacher plans her lesson based on the nature of her students, what they need to learn, and how they will best learn it. While teaching, she continually evaluates learning and can use a variety of pedagogical techniques that allow her to alter explanations, create demonstrations, and provide analogies that will support her students' understanding. Being able to convey knowledge effectively to students is the foundation of PCK.

Shulman's original concept of PCK has been re-conceptualized many times over in the application of various disciplines, most prominently mathematics and technology (Lannin, et al. 2013; Park, Jang, Chen, & Jung, 2011; Yurdakal et al., 2012). For the purposes of this article, PCK is defined as the intersection of a teacher's knowledge of content, pedagogy, and of the context of the learning situation, including her students.

Measuring Pedagogical Content Knowledge

Given evidence to support the link between PCK, effective instruction, and student achievement, researchers have sought to measure PCK and to develop tools and approaches that will aid in teacher evaluation (Hill, Ball, Blunk, Goffney, & Rowan, 2007; Schmelzing,

VanDriel, Juttner, Brandenbusch, Sandmann, & Neuhaus, 2012). PCK is a complex construct and has proven difficult to measure, however (Hill et al., 2007; Phelps & Schilling, 2004). Attempts at measuring PCK have included questionnaires, interviews, observation of instruction, student work product, and observation of teacher discussion on student learning (Bindernagel & Eilks, 2009; Krauss et al., 2008; Phelps & Schilling, 2004; van Driel, Verloop, & de Vos, 1998), among others. Some researchers have used just one measure, while others have compared or triangulated data from two or more sources. Each of these approaches has demonstrated benefits and drawbacks (Hill et al., 2007).

Paper-and-pencil tests have been used both as a stand-alone tool and in combination with other approaches. The benefit of tests is that they are easily administered to large groups, allowing for broad application. A prominent drawback is that they are more suitable for evaluating content knowledge than pedagogical knowledge in the context of varying content areas (Phelps & Schilling, 2004).

Item design is an important dimension of tests designed to measure PCK. Common item formats include closed and open-ended questions, concept mapping, and comments on videotaped lessons.

Closed-ended questions are easily scored but can be difficult to craft in that selected response formats can exclude potential answers and overlook individual teaching experiences. Responses provided in closed-ended items could help the participant select the correct answer, giving the impression that the respondent knows more than they actually do (Hill, Loewenberg, Ball, & Schilling, 2008).

Open-ended or constructed response questions may yield more elaborate responses but take more time and skill to score, in part defeating the utility of the survey (Koirala, Davis, & Johnson, 2008). Incomplete or brief responses can be interpreted as a lack of understanding or low motivation to respond (Schmelzing et al., 2012).

Observations of instruction provide great insight into a teacher's ability to perform PCK but require skilled or trained observers (Shanahan & Tochelli, 2014). Post-observation discussions can provide insight into a teacher's pedagogical reasoning which is particularly helpful after an observation of instruction. Those discussions require skilled facilitators, however, in order for conversations to be productive (Shanahan & Tochelli, 2014). Like observations, the time required for skilled evaluators to participate can be financially and otherwise burdensome (Hill et al., 2007; Shanahan & Tochelli, 2014).

Shulman (1988) explicitly stated that he did not see the effective evaluation of teachers as a simple testing. Instead he argued that multiple measures should be used and their results should be triangulated in order to establish a teacher's pedagogical skill. Each of these measures, used alone, would be insufficient for evaluation. When used together, however, "the flaws of the individual approaches to assessment are offset by the virtues of their fellows" (p. 38).

Measuring PCK is a common approach used in educational research for evaluating teacher pedagogy, however, there is no single established approach for measuring PCK. This article demonstrates the use of multiple data sources for a robust assessment of Pedagogical Content Knowledge. The intended audience is researchers who use PCK as a unit of analysis, and administrators who use PCK as a measure of teacher effectiveness. A complex approach to measuring PCK is required for a thorough evaluation of teacher pedagogy.

The research reported here is part of a larger study examining the effects of emergent literacy intervention provided by a kindergarten paraeducator. In this case, the primary investigator was in the kindergarten classroom conducting a research study and was an outsider in this environment. The PI's interest in the topic emerged from the experience of evaluating the paraeducator's PCK.

The question addressed by this study is: How do multiple data points triangulate to evaluate Pedagogical Content Knowledge? In order to answer this question we used a narrative qualitative approach informed by case study methods. We propose that PCK is more accurately measured through observation of instructional events, teacher interviews, and assessment of content knowledge.

Method

This article is informed by case study methods in which the unit of analysis is measuring Pedagogical Content Knowledge. Understanding the setting, participants, and instruction provides context for the analysis as is typical with narrative approaches in qualitative research. This study was approved by the University of Colorado, Boulder Institutional Review Board and followed all ethical practices in qualitative educational research.

Setting

This study took place in a kindergarten classroom at an elementary school in a large, urban school district located in the Rocky Mountain region. Just 30% of the students had earned a passing score on the state achievement test the previous year and 97% of the students qualified for the federal free and reduced lunch program. The student body was 20% African-American, 71% Hispanic, 1% Asian, and 8% White.

Participants

The part of the study being discussed in this paper included one instructor, Maria, and ten kindergarten students who had been identified as potentially at-risk for challenges with reading. Maria was a college freshman in a teacher education program that allowed her to work as a paraeducator in the mornings and attend classes in the afternoons.

Maria enjoyed an easy relationship with students in the class. She had a very calm affect and smiled a lot, although she was also an assertive disciplinarian. At this time of this study, Maria was 19 years old. Physically, she had a motherly presence and the children would frequently want to stand nearby and hug and touch her.

Maria's influence was enhanced by her shared ethnicity and cultural background with many of the students. She had grown up in the same neighborhood and had attended the same school.

Instruction

Maria provided supplementary literacy instruction to 10 children who were divided into two groups. The students selected for this instruction had been identified as most at-risk for reading failure. She met with both groups every day for approximately 25 minutes for 10 weeks. The intervention she provided was the Comprehensive Literacy Intervention for Kindergarten (CLIK) which had been developed by the Principal Investigator.

The CLIK program included three components: training for the paraeducator, a structured curriculum, and ongoing observations and instructional coaching.

Maria received two hours of training prior to the beginning of the intervention. The training session provided information on both language and literacy development as well as how to use the CLIK curriculum. The CLIK curriculum consisted of 50 structured lessons that were designed to take approximately 25 minutes each and be taught once a day for 10

weeks. A different storybook was used each week and the vocabulary and language and text comprehension were based on the storybook. Additional content included phonological awareness, phonics and print awareness. The PI observed Maria teaching the CLIK curriculum weekly throughout the intervention and met with Maria briefly, usually between five and ten minutes, after each observation. The PI prompted Maria to evaluate the lesson and review circumstances when Maria felt her instruction was more effective or less effective. The PI helped Maria problem-solve situations for future lessons by supporting Maria in discovering her own solutions, giving suggestions, or by providing explicit instruction, depending on Maria's need.

Data Collection

The PI collected data from three sources. The first was an assessment of Maria's knowledge of literacy development. The second were interviews with Maria conducted in the middle and after the intervention. The third were observations of Maria's teaching.

Pre-intervention assessment. The pre-intervention assessment touched on elements of literacy content knowledge and pedagogical knowledge. The questions probed Maria's knowledge of how to teach concepts of print, phonological awareness, alphabets, vocabulary, and comprehension.

One part of the assessment was of Maria's ability to hear and segment syllables, hear and segment phonemes, match phonemes, and rhyme. These questions were included to determine that Maria was able to perform the language-based tasks that she would be teaching.

Maria was also tested on her knowledge of the important content related to reading, including what various content is and when it is used. Examples of questions include, "How is phonological awareness different from phonemic awareness?" and "What are three reading comprehension strategies that are appropriate for kindergarten students?"

The PI also asked situational questions based on realistic examples of misunderstandings that can arise when teaching language and literacy skills to kindergartners.

Interviews. The PI interviewed Maria in the middle and at the end of the intervention. These interviews were open ended with the goal of being able to understand Maria's pedagogical reasoning. During these 90 minute interviews the PI pointed out events in Maria's teaching and asked her to explain her thinking that influenced her pedagogical decision-making.

Observations of instruction. The PI observed each group once per week for a total of 20 lessons observed over the 10 week period. During these observations the PI watched Maria's instruction and took notes on her demonstration of Pedagogical Content Knowledge. The PI was particularly interested in Maria's interactions that involved evidence that she could evaluate student understanding based on her students' responses and generate new representations of the content when she recognized a lack of understanding, the essence of Pedagogical Content Knowledge.

Data Analysis

All observations and interviews were transcribed and coded in HyperResearch, a software coding program. Coded data were recorded in a table listing eight instructional practices consistent with high PCK (Beck, McKeown, Hamilton, & Kucan, 1997, Appendix

A). Inter-rater reliability was established with the co-author by independently coding 15% of the data and discussing disagreements before coming to agreement. Although the lens of these eight constructs were used in initial coding, not all eight constructs yielded significant data in the analysis. The results are discussed through three central themes of high levels of PCK: vocabulary language, hand gestures for teaching new vocabulary, and storybook engagement. In addition, one instance of low PCK is discussed through teaching phonics and phonological awareness. These themes were selected because they encompass three or more of the eight pedagogical constructs. Through the themes, the complexity of PCK is evident.

Results

Evaluating Pedagogical Content Knowledge

Evidence of PCK in Maria's teaching was not difficult to find or group into the various alternate representations she used to affect student learning. In three areas, two related to vocabulary instruction and another concerning comprehension, there were significant contrasts between Maria's performance on one measure of PCK versus another. In a fourth area, phonological awareness, all assessments were consistent indicating Maria's lack of PCK.

Vocabulary language. One particular skill in which Maria demonstrated high PCK was in teaching vocabulary. The PI had multiple opportunities to observe Maria's vocabulary instruction, but would not have predicted her skill after the initial interview with Maria during which she stated what she would do with the students but also admitted that she did not know the meaning of the word in the example, indicating low content knowledge.

PI: As you read [with the students], you come across the word "graceful." You are fairly sure the students do not know its meaning. What would you do to teach it to them?

Maria: Ya, um...well probably first I would have to know exactly the meaning of the word and then try to put it into the kids language and tell it to them but in reality I don't know the true meaning of the word graceful.

If Maria had responded this way on a paper-and-pencil test, she would have been identified as being weak in vocabulary instruction. Indeed, her content knowledge was weak on this item and others like it, but observations of her teaching showed that not only did she learn the vocabulary in the curriculum easily, she was able to teach it effectively.

Maria demonstrated PCK in her vocabulary instruction was through using language that was unique to her and her students. Vocabulary words for the CLIK program were words that were slightly more sophisticated language for things and ideas that were already known to the children and found in their storybook for the week (Beck, McKeown, & Kucan, 2002). In order to engage her students, Maria developed her own language that both allowed the students to relate the new vocabulary to words they already knew, but also served to tighten the bond between her and the children.

For example, one week the vocabulary words were ancient and assemble. Maria referred to ancient as the "big kid word" for very, very old. The term "big kid word" became language that was only shared between Maria and her ten students. Other students in the class did not use the term, and Maria's students prized it as their own special connection to her, their group, and the language it represented. Every new vocabulary was a big kid word and had a regular word associated with it, regular words being the domain of other students in

the class who were not privy to the big kid words. Novel vocabulary became an opportunity to experience the esteem of being part of Maria's instruction and trusted with language to which others were not introduced.

Hand gestures for teaching new vocabulary. At times Maria found her students struggling to conceptualize some of the more abstract vocabulary included in the curriculum. In response, Maria developed new means of presenting unfamiliar vocabulary words to her students. One day The PI visited the group for an observation and found that Maria had begun using hand gestures to help her students understand and remember new words.

Maria: ...the other one was darted. Do you remember what that means?

Kids: Fast. Fast. Fast.

Maria: To move quickly. How do we do it?

Kids: Like this. (Kids do the hand motion for darted).

Maria: Now that we know those words, let's go ahead and read.

The hand motions created by Maria were consistently fun, short, and provided the students with a strong link to the vocabulary. Her students seemed to enjoy doing them, and on more than one occasion. The PI observed her students using the hand motions with one another when they discussed the vocabulary in other contexts, away from Maria's instructional group.

The PI was able to evaluate Maria's pedagogical reasoning during the post-intervention interview. She asked Maria about the hand motions she had developed to represent relatively abstract ideas from the text:

PI: ...another piece that you brought in that I thought was wonderful that you always had some sort of movement to represent the word you were trying to teach. Can you say more about that?

Maria: I would basically, like skyscraper, it's a really tall building, so I would have them raise their hands up and look up like they were looking at a really, really tall building. Or graceful, I would have them move their hands across in pretty ways.

PI: What made you think to do that? Was it something you had learned in a class or that you had watched another teacher do or was it something that you put together on your own?

Maria: Actually, when we first started I noticed that they weren't really clicking if I just had them say it, so I just kind of thought about it, what if I added something to it? I don't remember which word I did it with first, but it just clicked and it was kind of unconscious, I just kind of did it.

In this example, Maria's response to her students' lack of understanding was effective. Not only did her students use the hand motions as representations of new vocabulary, but they generalized that strategy to other instruction.

In the post-observation conference, however, it became apparent that Maria's pedagogical reasoning was not necessarily clear to her but an idea grounded in common sense. Applying the use of hand gestures to this circumstance was an idea she believed might work. She was unable to articulate her reasoning for selecting that strategy over others or where the idea for the hand gestures came from, however.

Storybook engagement. During the pre-intervention interview, the PI asked Maria how she would introduce a new storybook to her students. Maria responded that she would have the students look at the front cover and the illustrations throughout the text which is a common approach called a “picture walk,” and a reasonable response to the question.

As Maria introduced new storybooks to her students, she did the picture walk with them and then continued with a common practice of reading while the students followed along in their own copy of the book. Maria would periodically stop to ask questions but her students typically responded in one-word answers, if at all. The students became distracted and Maria spent more and more of her time redirecting off-task behavior than discussing the story.

Although Maria’s response to the PI’s question regarding introducing a new text described a strategy that would be effective in most circumstances, Maria’s students were an exception. All ten children lived in poverty or near-poverty. One was homeless, two others slept on the floor in the homes of relatives. Several received scant food unless it came from the school. It was easy for the students to lose interest and it grew increasingly difficult for Maria to engage her kindergartners in learning.

In order to increase her students’ engagement, Maria developed her own approach to introducing her students in the stories she used each week. Rather than having the students read the story along with her, Maria read the book to the students, which allowed them to enjoy the story without the distraction of pointing to the correct word or stopping the story to redirect an off-task student. Afterward, Maria told the students that the book was going to give them a picture, all for themselves. Their job was to receive the picture from the book and imagine it.

Maria: We're not going to read the story [together] today. Put your hands on the book. Close your eyes and think, because the book is going to give you a picture. Think about your favorite picture, really, really hard. Look at all the colors, at what the characters are doing, everything. When you are ready, open your eyes and open the book. Lucia, what did this story remind you of?

Kids: When they were dancing.

Maria: What else did your picture say?

Kids: (Quiet).

Maria: Say more because there are a lot of pictures in this book where the dinos are dancing. I don't really know which one you are talking about until you tell me some more about it. What else is going on? Do you know? ...what did the picture give you?

Kids: The person was dancing with the dinosaur and they were having a lot of fun and went to sleep.... one person was sleeping.

Maria: Oh, I know what she's talking about. When all the dinosaurs were dancing and one was in bed. And what do the shadows look like?

Kids: Dinosaurs. Roar. Like dinosaurs.

Maria: Ya, their shadows were in the shapes of dinosaurs.

Once the students had imagined and described the picture the story had “given them,” they were much more interested in repeated readings, reading along, and discussing the text. The students felt connected to the text in ways they had not previously.

Teaching phonics and phonological awareness. Unlike vocabulary and storybook engagement instruction, where Maria was a skilled teacher despite the fact that she struggled to describe her instructional approach, comparing testing, observation, and response to

coaching it was clear that Maria's PCK for teaching phonics and phonological awareness were weak.

She struggled with phoneme segmentation and phoneme matching in an assessment of her skills prior to the beginning of the intervention, accurately responding to four of nine two, three, four, and five phoneme words. Maria had even more difficulty matching phonemes, scoring just one correct out of five prompts correctly.

The pre-intervention test also indicated that Maria was unclear about how she would teach a student who had difficulty reading a word. She shared that she would help him separate the word into phonemes or syllables, but did not have an idea as to how she would do that.

PI: As you read, the students are choral reading "His companions were named Goodly, Lovely, Angel, Neatly, and Perfect" with you. You can hear that one of the students is stumbling on the word "companion." He says the initial /k/ once and gets the /p/ sound once, but doesn't say the whole word. You stop reading the book momentarily in order to help him. What would you do to help him get the word right the next time he reads it?

Maria: Probably help him separate the word into two different syllables

Ann: So what would you say to him?

Maria: I would tell him that if he could sound out each letter separately and then put it together in some way.

PI: Would you do each letter separately, or you said initially syllables.

Maria: I would tell him to do each letter separately and then put it together into syllables and then he would eventually be able to put the word together. Breaking words apart is one way to help a child read a word but in this example Maria was unclear as to how she would have the student break the word apart, and then says that she would have the student "put it together in some way."

Through observations of Maria's teaching the PI found that rather than using strategies to help students determine whether two consonant sounds matched or not, she would skip a response altogether, provide the correct answer, and continue with the lesson.

Maria: Good job, Eddie. Can you rhyme something with truck?

Eddie: ut

Maria: ut?

Eddie: hot

Maria: Okay, keep on thinking, You're really close, try again. Truck, something with uck in it.

Students: rut

Maria: rut? Okay I'll take that.

In her post-intervention interview, Maria confirmed that she was most comfortable teaching students struggling with phoneme-related tasks by using the white board to write out the letters. On one occasion when Maria's students were struggling with the oral blending of onsets and rimes, she pulled out a white board and wrote the onsets and rime which turned a phonological awareness task into phonics. Afterward, the PI asked Maria what was difficult about teaching phonological awareness tasks.

Maria: When they couldn't see or touch what I was telling them, when they just had to use their pure imagination about stuff, they couldn't really get it... Like the rhyming, when I was at first trying to do the rhyming with them I would tell them *cat rhymes with hat* they could not see that, they could not see how it worked. So that's when I got the [white] board and said, *okay, this says -at, so let's just take this away and put another one.*

At a loss for how to create alternate representations, Maria turned to matching phonemes with letters, and approach she was more comfortable with but also one that ceased to meet the instructional objective of the lesson, which was distinguishing and generating oral rhymes.

Discussion

Knowledge of content is easily evaluated in a test. Knowledge of pedagogical approaches or pedagogical reasoning for particular circumstances can be described verbally or in writing. Teachers can also provide information on things like the impact of prior instruction, community context or family factors on student learning. The effective practice of Pedagogical Content Knowledge is a performance-based task. The ability to synchronize those funds of knowledge (Moll, Amanti, Neff, & Gonzalez, 1992) into a teaching and learning event, however, is based on classroom interactions that occur in a single moment, requiring quick pedagogical reasoning and flexible implementation of various pedagogies.

Pedagogical Content Knowledge is a sophisticated construct with variables that are grounded in classroom interactions with multiple dynamics. Appropriate pedagogies are based on content and student characteristics. Students and their home and school contexts are continually changing. Creating alternate representations requires the ability to assess student learning quickly and accurately and then use pedagogical reasoning.

New representations of content must be based on a teacher's knowledge of his students. Individual factors of language, background knowledge, and cognitive abilities, including a student's ability for abstract versus concrete thought, are all required in order to practice PCK effectively (Shulman, 1986).

Maria's ability to contextualize content required a solid knowledge of her students' understanding of their world. Maria was familiar enough with her students, their understandings, beliefs, and knowledge base that she could quickly tie new content into their existing schema. Each of these strengths in Maria's teaching is evidence of her ability to check for her students' understanding, access her understanding of pedagogical approaches and her knowledge of emergent literacy content, and create new representations resulting in student success.

Performing skilled Pedagogical Content Knowledge requires a pedagogical reasoning that is grounded in the exchange between teacher and student. The teacher presents information and must evaluate student learning nearly simultaneously in order to determine whether she can continue or must develop and provide alternate representations of the knowledge or skills being taught. Effective alternate representations must be based on the cause and nature of the misunderstanding, which will likely vary significantly from one instructional event to another.

Now, we are able to consider the question: how do multiple data points triangulate to evaluate PCK. By triangulating data from multiple sources the authors were able to evaluate PCK in a more complex and thorough manner.

Assessing Maria's knowledge of reading skills and pedagogy yielded valuable information. Testing her skills in phoneme discrimination provided insight as to why her phonological awareness instruction was weak. Conversely, Maria scored poorly on the initial

assessment of vocabulary, but could demonstrate effective vocabulary skills in the classroom. Interviewing Maria gave her an opportunity to explain her pedagogical reasoning. Observing Maria's teaching allowed her to demonstrate knowledge and skills that had not been evident in the other data. Each of these measures alone was insufficient to evaluate Maria's Pedagogical Content Knowledge. It was only through a comparison of these data that Maria's PCK became clear.

Use of tests of content knowledge may be more appropriate for evaluation of PCK for teachers in secondary schools. A secondary teacher needs an in-depth understanding of the content they teach in order to create alternate representations of high-level material. It could stand to reason that because the more content-intensive courses in middle and high schools require more in-depth content knowledge that evaluation of teachers' PCK in those settings would be more heavily weighted toward content knowledge assessment.

Elementary teachers are responsible for ensuring learning of a wide variety of content and skills. The disciplinary organizations establish content knowledge standards for elementary teachers as well, but elementary teachers are not specialists, they have a broad knowledge base of many skills and content.

An integral part of PCK is the teacher's ongoing assessment of student learning and the ability to "create powerful representations of the ideas to be learned in the form of examples, analogies, metaphors, or demonstrations" (Shulman, 1987, p. 37). Insights gained through interviewing Maria allowed for increased understanding of her process of creating those new representations. Triangulating results from interviews, observations, and a paper and pencil test afforded a more valid assessment of Maria's PCK than using any one of those measurements alone.

Limitations

The drawback of the approach used in this study is that, given the time required, it is a difficult model to scale up for larger populations without a significantly larger research team. The process was highly time intensive, involving assessment, multiple observations of teaching and several interviews. However, there does not seem to be an easy approach to measure PCK that demonstrates the complexity of what is involved in teaching and interacting with students. In this case, we focused on a paraeducator. However, we argue that this approach of using multiple points of data can be used effectively for evaluating teachers' PCK.

Generalizability

In answering the question, how do multiple data points triangulate to evaluate PCK, we hope to engage our readers with an understanding of the complexity involved in this evaluation and research approach. In the current climate of using student test scores as the primary means of evaluating teachers, we hope to illustrate that any one data point used is unlikely to capture the richness of classroom interactions.

Implications

Measuring PCK is a complex process. Teacher evaluations based on just one data point for measuring these complex concepts should be interpreted with caution. Therefore, the implications are clear—when we are trying to measure complex concepts in teaching, a robust system must be in place including content assessment, multiple observations, and interviews over time.

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Appendix A

Eight Pedagogical Constructs (Beck, McKeown, Hamilton, & Kucan, 1997)

1. Turning Back to Students
 - a. Turns responsibility back to students for thinking through and figuring out ideas
2. Revoicing
 - a. Interprets what students are trying to express and rephrases ideas so students can become part of the discussion
 - b. Raises the level of language
3. Gives specific feedback on performance
 - a. Communicates clearly what students did correctly or how they can improve
 - b. Focuses on specifics, not just right and wrong
4. Marking
 - a. Draws attention to an idea in order to mark it's importance
5. Provides support to students who need assistance
 - a. Breaks the task down when students are struggling
 - b. Reminds students of a rule or strategy to use
6. Organizes instruction in ways that allow most students to respond
 - a. Allows time for students to process and doesn't immediately give the answer
 - b. Calls on multiple students
7. Pacing
 - a. Allows students time to engage in tasks
 - b. Moves on when most students have mastered task
 - c. Transitions are quick; students stay engaged through transition
8. Connects to previous instruction
 - a. Reviews ideas previously learned
 - b. Draws on concepts and ideas learned in other subjects

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